(12) UK Patent Application (19) GB (11) 2 358 896 (13) A

(43) Date of A Publication 08.08.2001

(21) Application No 0002489.3

(22) Date of Filing 03.02.2000

(51) INT CL[7]
F16D 59/02

(52) UK CL (Edition S)
F2E EG EQ
U1S S1874

(56) Documents Cited
US 5699883 A

(58) Field of Search
UK CL (Edition R) F2E EG EQ
INT CL[7] F16D 59/02 63/00 , H02K 7/102
Online:WPI,EPODOC,JAPIO

(71) Applicant(s)
Lansing Linde Limited
(Incorporated in the United Kingdom)
Kingsclere Road, BASINGSTOKE, Hants, RG21 6XJ,
United Kingdom

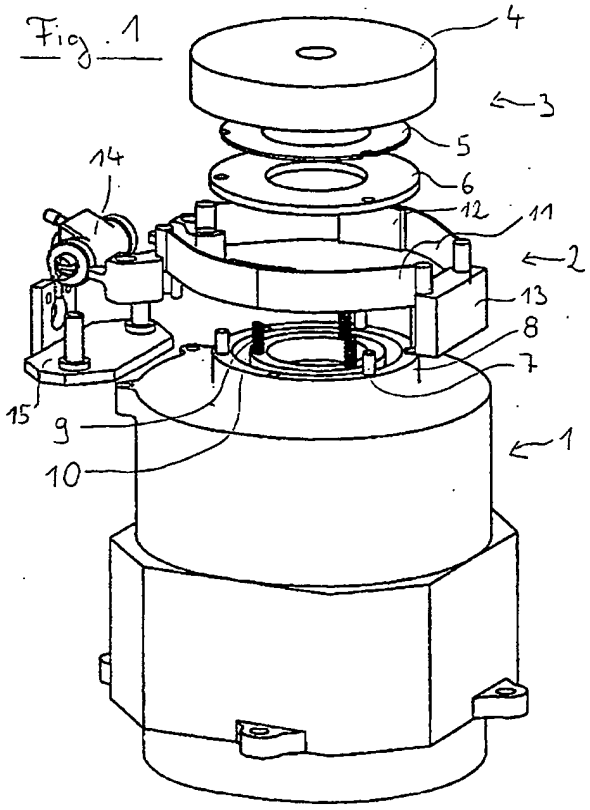
(72) Inventor(s)
Paul John Eckersley
Timothy John Rumney

(74) Agent and/or Address for Service
Boult Wade Tennant
Verulam Gardens, 70 Gray's Inn Road, London,
WC1X 8BT, United Kingdom

(54) Abstract Title
Drive unit for a vehicle

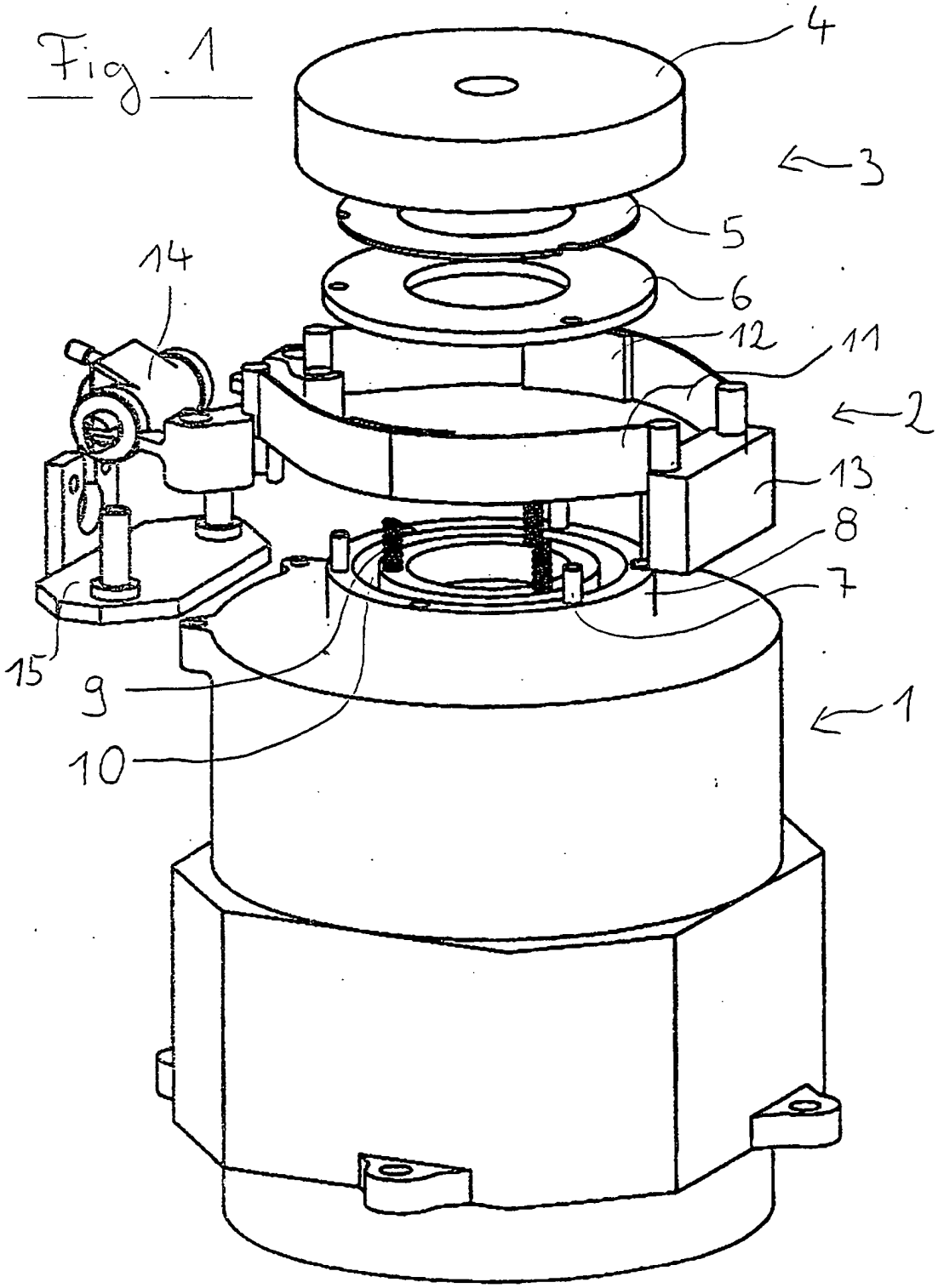
(57) A drive unit for a vehicle, for example an industrial truck, has an electric motor 1, an energy-storage brake 3 comprising a spring engaged electromagnetically released friction lining 5 and a service brake 2 configured as a band brake. The energy-storage brake and the service brake are arranged in the region of the electric motor and have a common brake body 4 secured to a motor shaft of the electric motor.

Fig. 1



GB 2 358 896 A

Fig. 1



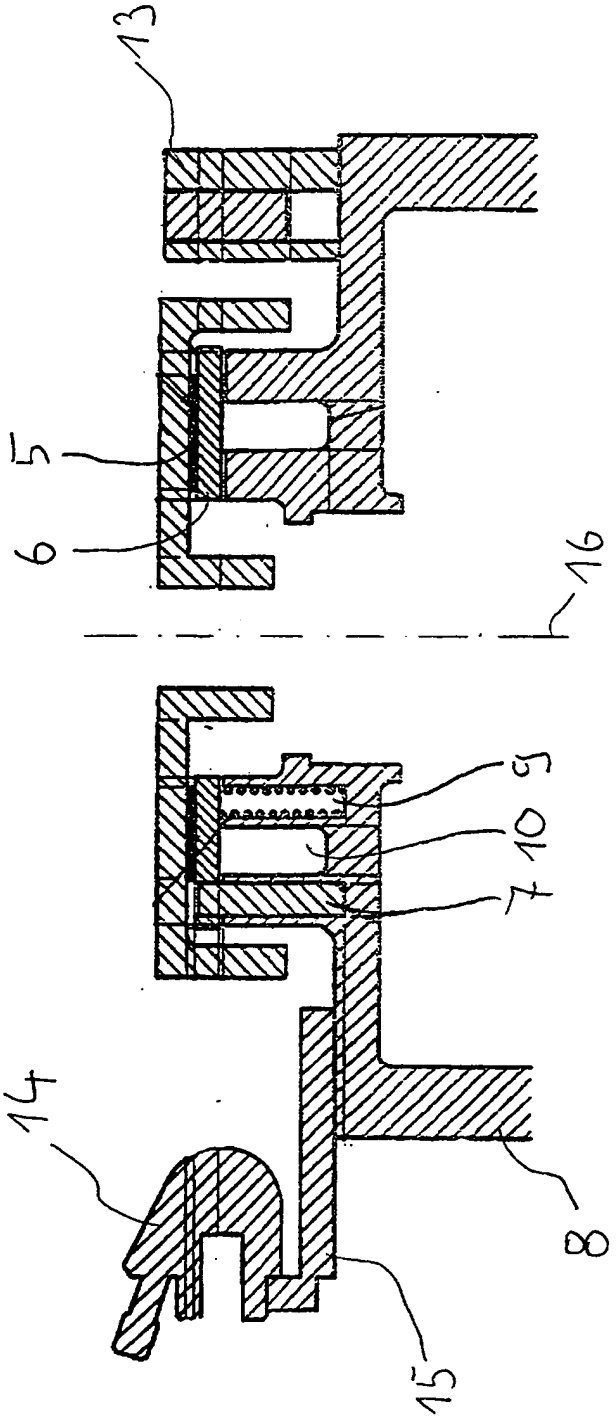


Fig. 2

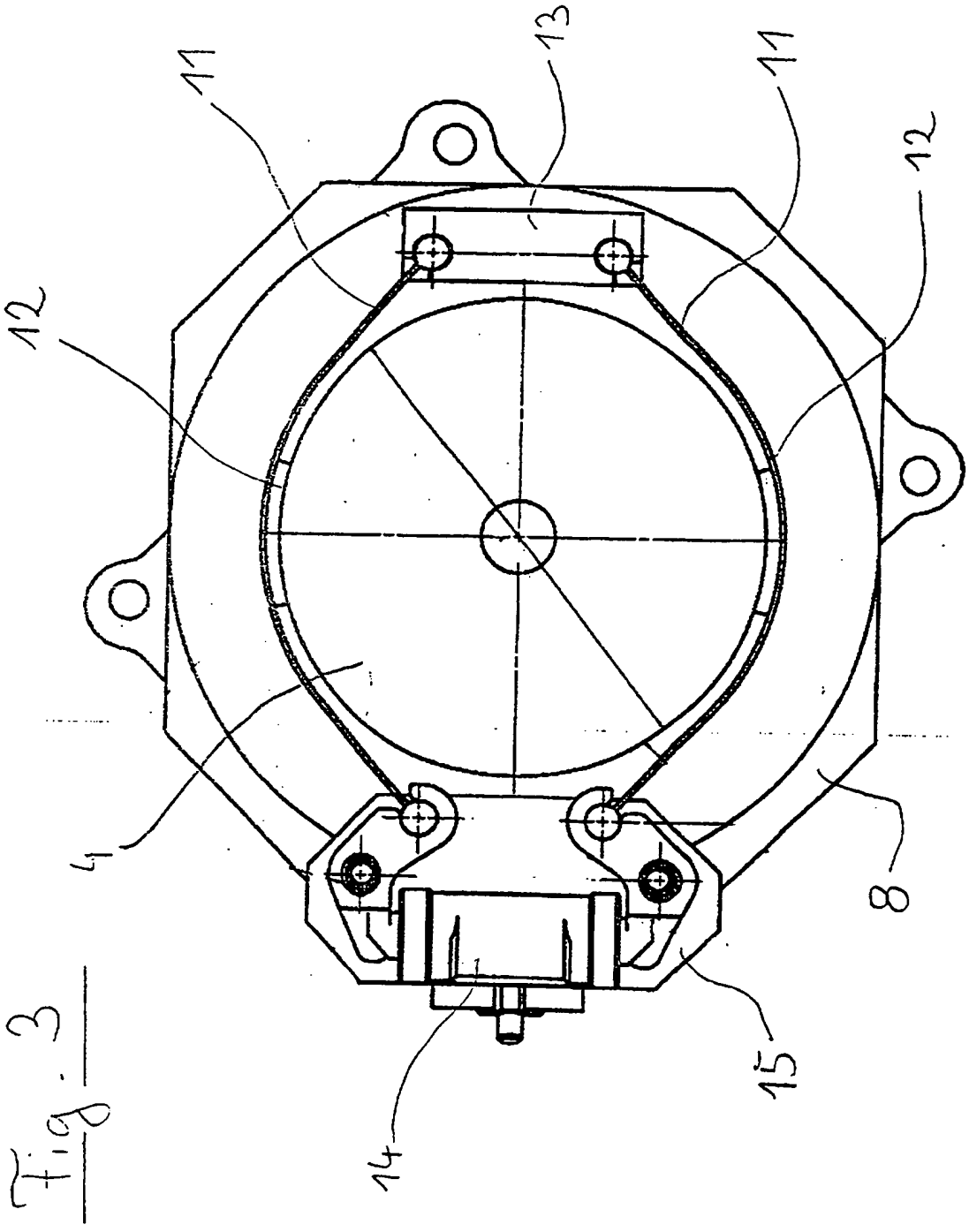


Fig. 3

Fig. 4

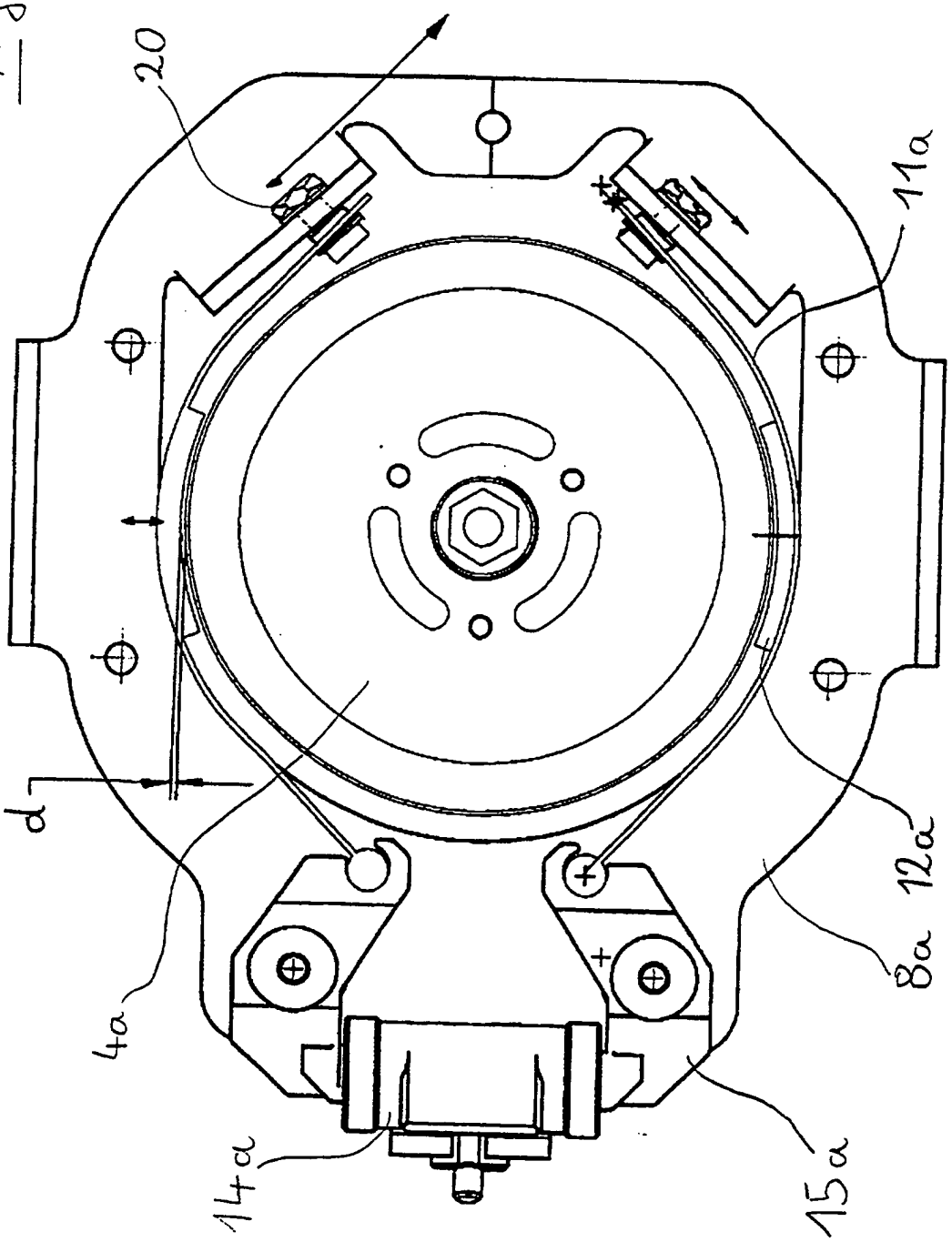
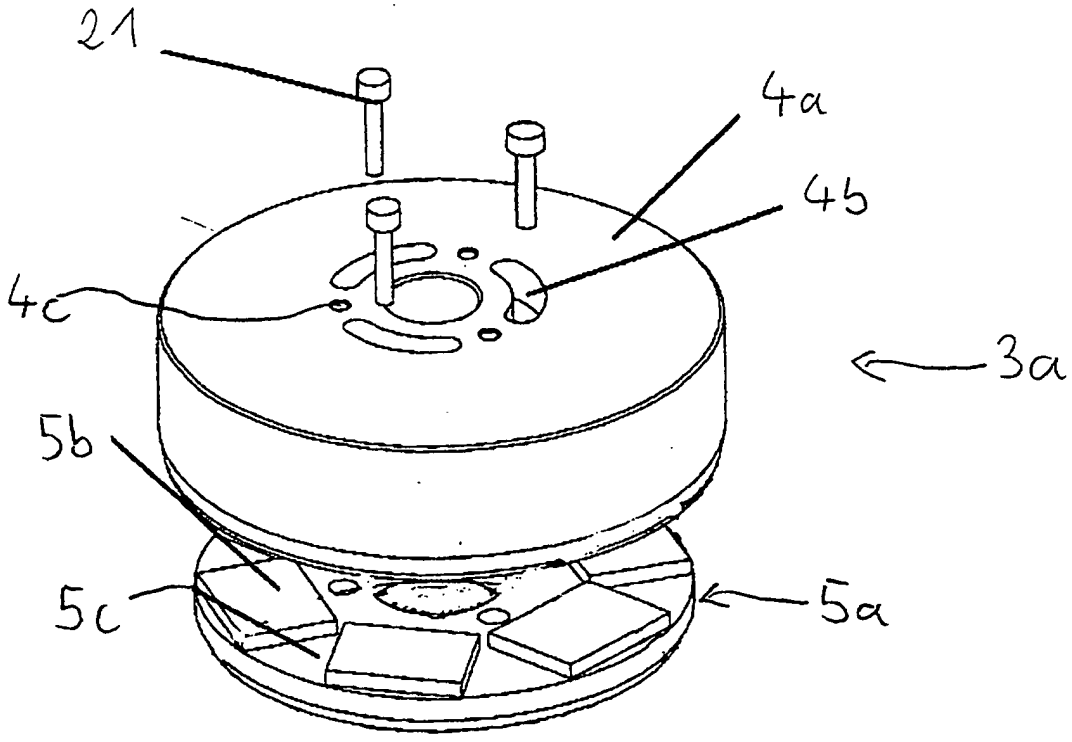


Fig. 5



Drive Unit For A Vehicle

The invention relates to a drive unit for a vehicle, in particular but not exclusively for an industrial truck, having an electric motor, an energy-storage brake which can be electromagnetically disengaged and a service brake which can be arbitrarily actuated. The invention also relates to a vehicle, e.g. an electrically operated industrial truck, having a drive unit of the above kind.

Electrically driven vehicles generally have two brake systems operating independently of one another, an energy-storage brake and a service brake being frequently provided. The energy-storage brake is then always actuated when the vehicle is out of operation and is therefore frequently designated as a parking brake. The braking torque generated by the energy-storage brake is not generally variable. In contrast to this, the braking torque of the service brake can be arbitrarily set by the person operating the vehicle, for example by means of a brake pedal.

Industrial trucks, in particular, such as fork-lift trucks, fork-lift reach trucks or commissioner units are frequently equipped, as described above, with an energy-storage brake and a service brake. The energy-storage brake and the service brake are then generally separately embodied and act directly on a driven wheel of the vehicle. Also known are arrangements in which one of the two brakes acts on a shaft of the electric drive motor of the vehicle, while the other brake acts on a wheel, which is connected to the drive motor by means of a gear. In this arrangement also, the energy-storage brake and the service brake are configured as units which are independent of one another.

These known drive arrangements with two mutually independent brakes are complex in design and demand a substantial outlay in manufacture and assembly.

An object of the invention is to simplify the drive arrangement for a vehicle having an energy-storage brake and a service brake.

In accordance with the invention, there is provided a drive unit for a vehicle having an electric motor, an energy-storage brake which can be electromagnetically disengaged and a service brake which can be arbitrarily actuated, wherein the energy-storage brake and the service brake are arranged in the region of the electric motor and act on a motor shaft of the electric motor. In this arrangement according to the invention, additional brakes do not have to be arranged on the wheels of the vehicle. In an arrangement with an intermediate gear, the electric motor has a higher rotational speed than the drive wheel of the vehicle. It follows from this that, in the case of the arrangement according to the invention, the braking torque to be applied by the brakes is smaller than in the case of an arrangement of brakes in the region of a drive wheel.

In accordance with an advantageous further embodiment of the invention, the energy-storage brake and the service brake have a common brake body which is connected to a motor shaft of the electric motor. The brake body can, for example, be configured as a brake disc, as a multiple disc pack or as a brake drum and is rigidly connected torsionally relative to the motor shaft of the electric motor. If the energy-storage brake and the service brake have a common brake body, it is possible to economize on some components, relative to an arrangement of the prior art.

In one embodiment of the invention a brake lining of the energy-storage brake is pressed in axial direction onto the brake body. The actuation force of the energy-storage brake is parallel to the motor shaft of the electric motor. Relative to the energy-storage brake, therefore, the brake body has the shape and function of a brake disc.

The energy-storage brake preferably has at least one spring, by means of whose spring force the brake lining can be pressed onto the brake body. In this embodiment, the energy-storage brake is configured as a spring energy-storage brake.

It is particularly advantageous for the spring to be arranged in a casing component of the electric motor. It is therefore unnecessary to provide separate supports or guides to accommodate the spring.

The energy-storage brake preferably has at least one magnetic coil by means of which a magnetic force, which is applied in opposition to the spring force, can be exerted on the brake lining or on a component connected to the brake lining.

If the coil is arranged in a casing component of the electric motor, this provides the advantage that it is possible to dispense with a coil casing as an independent component.

The magnetic field lines of the electromagnet are at least partially guided by means of the casing component of the electric motor. The casing component of the electric motor then guides the magnetic field lines in the desired direction.

In another embodiment of the invention a brake lining of the service brake is pressed in the radial direction onto the brake body.

It is then advantageous for the service brake to be hydraulically actuated. The service brake can be constructed from standard components such as are used, for example, in motor vehicles.

The service brake then expediently has a hydraulic brake cylinder.

A particularly space-saving arrangement is present if the service brake is configured as a band brake.

It is likewise possible for the service brake to be configured as a shoe brake, preferably as an external shoe brake.

Preferably the drive unit defined above is for an electrically operated industrial truck. The invention also provides a vehicle, e.g. an electrically operated industrial truck, having a drive unit as defined above.

Further advantages and details of the invention are explained more precisely in the specific embodiment, by way of example, described with reference to the accompanying diagrammatic drawings in which:-

Fig. 1 shows an exploded, perspective view of a drive unit according to the invention,

Fig. 2 shows, in cross section, a detail from the drive unit of Figure 1;

Fig. 3 shows, in plan view, the drive unit of Figure 1;

Fig. 4 shows, in plan view, a second embodiment of a drive unit according to the invention, and

Fig. 5 shows, in perspective view, a detail from the drive unit of Figure 4.

Referring to the drawings, Fig. 1 shows, in an exploded view, a drive unit according to the invention which has, as essential constituents, an electric motor 1, a service brake 2, which can be arbitrarily actuated, for example, ~~by~~ hydraulically, and an energy-storage brake 3, which can be electromagnetically actuated, i.e. disengaged. A drive

unit of the design shown can, for example, be used as the drive unit for moving an electrically operated industrial truck. The service brake can be arbitrarily actuated by the person operating the industrial truck and is employed for the braking procedures necessary during normal operation. The energy-storage brake, whose braking torque is set to a fixed amount, is used as the parking brake and as the emergency brake.

The energy-storage brake 3 and the service brake 2 have a common brake body 4 which is rigidly connected torsionally to a shaft (not shown) of the electric motor 1. The energy-storage brake 3 also includes a brake lining 5 and a pressure plate 6, which are guided in axial direction by means of guide spigots 7 in a casing component 8 of the electric motor 1. In addition, springs 9 are fastened to the casing component 8 and these springs exert, via the pressure plate 6, a pressure force directed in the direction of the brake body 4 onto the brake lining 5. An electromagnetic coil (not shown) is arranged in an annular gap 10 arranged in the casing component 8. By means of this electromagnetic coil, the pressure plate 6 is pulled in the direction of the casing component 8 against the force of the springs 9. It therefore unloads the brake lining 5 and can disengage the brake body 4.

In the present embodiment, the service brake 2 is configured as a band brake. Two brake bands 11 with brake linings 12 are fastened on the casing component 8 by means of a retention feature 13 on the right-hand side of the unit as viewed in Fig. 1. The brake bands 11 can be tensioned by means of a hydraulic brake cylinder 14 on the left-hand side of the unit as viewed in Fig. 1 so that the brake linings 12 are pressed in radial direction onto the brake body 4. The brake cylinder is likewise fastened on the casing component 8 of the electric motor 1 by means of a

retention feature 15.

Fig. 2 shows a cross section through the upper section of the drive unit. The casing component 8 of the electric motor is shown with recesses for accommodating the springs 9 and the guide spigots 7. A peripheral annular groove 10 is provided for accommodating the coil of the electromagnet. The pressure plate 6 and the brake lining 5, which are guided by the guide spigots 7, are arranged above the casing component 8. The brake body 4 is located, in the position shown, on the brake lining 5 and can be rotated, jointly with the motor shaft (not shown), around the central axis 16. Likewise shown are the retention feature 13 for the brake bands (see Fig. 1) and the retention feature 15 for the brake cylinder 14.

Fig. 3 shows the drive unit in plan view. The arrangement of the service brake 2, in particular, is to be seen in this representation. The brake cylinder 14 acts on two symmetrically arranged levers 16 which are pivotably supported on the casing component 8 and are each connected to a brake band 11. The brake bands 11 are tensioned by driving the piston out of the brake cylinder 14 so that the brake linings 12 are pressed onto the brake body. The magnitude of the braking torque is, in this arrangement, directly dependent on the hydraulic pressure present in the brake cylinder.

Fig. 4 shows a second embodiment of a drive unit according to the invention in plan view. Very similar to the first embodiment shown in Fig. 3, this second embodiment comprises a brake cylinder 14a which acts on levers 16a pivotably supported on a casing component 8a. Each lever 16a is connected to a brake band 11a with brake linings 12a. The cylinder 14a is shown in its inoperative position with the pistons completely retracted. In this position the brake

linings 12a are slightly distanced from the brake body 4a, providing an operating clearance d. In this second embodiment the operating clearance d of each brake lining 12a can be adjusted by adjustment devices, which connect the brake bands 11a to the casing component 8a. Each adjustment device comprises a screw 20 movable along a slot in the casing component 8a. The screw, which is connected to the brake band 11a can be secured to the casing component 8a.

Fig. 5 shows, in perspective view, a detail from the second embodiment of the drive unit according to Fig. 4. The brake body 4a has access holes 4b which allow access to the inside of the energy storage brake 3a. The screws 21 allow loosening of the energy storage brake 3a mechanically by screwing them into the threaded holes 4c, when the brake is not powered. The screws 21 are standard parts which are removed completely for normal use of the drive unit. A software interlock can ensure that the screws 21 cannot be left in by mistake.

The brake lining according to Fig. 5 consists of a carrier plate 5a for multiple lining pads 5b. The free space 5c between adjacent lining pads 5b allows worn particles to escape between the pads 5b, thereby preventing jamming.

CLAIMS

1. Drive unit for a vehicle, having an electric motor, an energy-storage brake which can be electromagnetically disengaged and a service brake which can be arbitrarily actuated, wherein the energy-storage brake and the service brake are arranged in the region of the electric motor and act on a motor shaft of the electric motor.

2. Drive unit according to Claim 1, wherein the energy-storage brake and the service brake have a common brake body which is connected to a motor shaft of the electric motor.

3. Drive unit according to Claim 1 or Claim 2, wherein a brake lining of the energy-storage brake can be pressed in axial direction onto the brake body.

4. Drive unit according to one of any of the preceding claims, wherein the energy-storage brake has at least one spring, by means of whose spring force the brake lining can be pressed onto the brake body.

5. Drive unit according to Claim 4, wherein the spring is arranged in a casing component of the electric motor.

6. Drive unit according to any one of the preceding claims, wherein the energy-storage brake has at least one magnetic coil by means of which a magnetic force, which is applied in opposition to the spring force, can be exerted on the brake lining or on a component connected to the brake lining.

7. Drive unit according to Claim 6, wherein the coil is arranged in a casing component of the electric motor.

8. Drive unit according to Claim 7, wherein the magnetic field lines of the electromagnet are at least partially guided by means of the casing component of the electric motor.

9. Drive unit according to any one of the preceding claims, wherein a brake lining of the service brake can be pressed in radial direction onto the brake body.

10. Drive unit according to any one of the preceding claims, wherein the service brake can be hydraulically actuated.

11. Drive unit according to Claim 10, wherein the service brake has a hydraulic brake cylinder.

12. Drive unit according to any one of the preceding claims, wherein the service brake is configured as a band brake.

13. Drive unit according to any one of the preceding claims, wherein the service brake is configured as a shoe brake.

14. Drive unit according to any one of the preceding claims for an electrically operated industrial truck.

15. A drive unit for a vehicle substantially as hereinbefore described with reference to and as shown in the accompanying drawings.

16. A vehicle having a drive unit as claimed in any one of the preceding claims.

17. An electrically operated industrial truck having a drive unit as claimed in any one of the preceding claims.

Application No: GB 0002489.3
Claims searched: 1-17

Examiner: Peter Squire
Date of search: 4 July 2000

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.R): F2E EG EQ

Int Cl (Ed.7): F16D 59/02 63/00 H02K 7/102

Other: Online:WPI,EPODOC,JAPIO

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	US 5699883	(Albrecht) see whole document and particularly col.3 line 56 to col.4 line 8	1-4, 6

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.